

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
28 July 2005 (28.07.2005)

PCT

(10) International Publication Number
WO 2005/068978 A1

(51) International Patent Classification⁷: **G01N 21/47**,
21/41, 21/63, 21/21, 15/06

(21) International Application Number:
PCT/CA2005/000044

(22) International Filing Date: 14 January 2005 (14.01.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/536,228 14 January 2004 (14.01.2004) US
2,468,924 28 May 2004 (28.05.2004) CA

(71) Applicant (for all designated States except US): **LASER
DIAGNOSTIC INSTRUMENTS INTERNATIONAL
INC.** [CA/CA]; 146 Colonnade Road South, Unit 1,
Ottawa, Ontario K2E 7Y1 (CA).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **DUDELZAK,
Alexander E.** [CA/CA]; 48 Sheahan Crescent, Ottawa,
Ontario K2H 8M2 (CA). **PASMANIK, Guerman A.**
[CA/CA]; 429-1875 Steeles Avenue West, North York,

Ontario M3H 5T7 (CA). **SHILOV, Alexander** [RU/CA];
51 Forest Run Boulevard, Vaughan, Ontario L4K 5J7
(CA). **SHKLOVSKIY, Evgueni** [RU/CA]; 321-1875
Steeles Avenue West, North York, Ontario M3H 5T7 (CA).

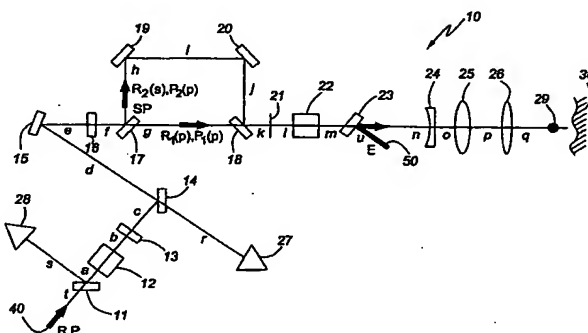
(74) Agents: **PROBERT, Heather** et al.; Shapiro Cohen, P.O.
Box 3440, Stn D, Ottawa, Ontario K1P 6P1 (CA).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,
KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,
MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG,
PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,
ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,
FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO,
SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN,
GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: A DEVICE AND METHOD FOR NON-CONTACT SENSING OF LOW-CONCENTRATION AND TRACE SUBSTANCES



(57) Abstract: A device for non contact detection of low concentration substances outside a laboratory environment is disclosed. A probing laser emission is split into two linear orthogonally polarized emission components and one component is delayed in time relative to the other. Both components are directed to a focal region that is proximate to a target medium thought to contain the substance to be detected. Between the arrival of the first and second emission components, an excitation light pulse at a wavelength corresponding to an absorption line in the spectrum of the substance is directed to the focal region. If vapours of the substance are present, they will be heated by the excitation pulse and will change the index of refraction of the focal region before the second emission component passes through it, thus altering the phase of the back-scattered emission returns. The device delays the first returned component by an equal delay and coherently couples the returned emission components. The amplitudes of the orthogonally polarized returned emission components are compared. If the probing laser is pulsed, the ratio of the polarized pulse components is observed to indicate the presence of the substance. Optionally, reference pulses for which no excitation pulse is generated may be introduced to provide a reference signal to rule out effects due to the intrinsic polarization caused by passage of the emission through optical components. If the probing laser is a continuous wave laser, the presence of transients timely correlated with excitation pulses in the detected continuous wave signal will indicate the presence of the substance.



Declaration under Rule 4.17:

— *of inventorship (Rule 4.17(iv)) for US only*

Published:

— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.